To: T10 Technical Committee
From: Rob Elliott, HP (elliott@hp.com)
Date: 19 July 2004
Subject: 04-171r1 SBC-2 Make FORMAT UNIT modes optional

Revision history
Revision 0 (24 May 2004) First revision as "Make FORMAT UNIT, READ (16), and WRITE (16) optional"
Revision 1 (19 July 2004) Incorporated comments from July 2004 CAP WG meeting - keep them mandatory, but make the non-zero parameter list optional. Plan on submitting letter ballot comments marking each 8-byte LBA commands as mandatory if that command is implemented with a 4-byte LBA (e.g. must implement VERIFY (16) if any VERIFY (n) is implemented).

Related documents
sbc2r14 - SCSI Block Commands - 2 revision 14

Overview
1. The FORMAT UNIT command, its use with a parameter list containing zero bytes of short block format defect descriptors, should not be mandatory. This command is usually not useful for virtual disk drives presented by RAID controllers, which just implement it as a no-op. Rather than lie, logical units should be allowed to return CHECK CONDITION/ILLEGAL REQUEST/INVALID COMMAND OPERATION CODE.

2. READ (16) and WRITE (16) should not be mandatory for all SBC-2 logical units. They were made mandatory in November 2000 (T10 plenary minutes 00-375r1 motion 10.4.4): "READ (16) and WRITE (16) [shall] be made mandatory for the direct-access device type." The reasoning was logical units not supporting them could continue to claim compliance with SBC-1. However, the protection information feature added in 2003 is not dependent on the 8-byte LBA feature and does not require READ (16) and WRITE (16) to be useful. Logical units implementing it should be able to claim SBC-2 in their INQUIRY version descriptors.

Suggested changes

5.2 Commands for direct-access devices overview

The commands for direct-access devices are listed in table 1. Commands with CDB or parameter data fields that support protection information are indicated by the "Protection information" column.

Table 1 — Commands for direct-access devices (part 1 of 3)

Command name	Operation code	Type [a]	Protection information	Reference
...	86h	O	no	SPC-3
FORMAT UNIT	04h	M	yes	5.3
INQUIRY	12h	M	no	SPC-3
LOG SELECT	4Ch	O	no	SPC-3
LOG SENSE	4Dh	O	no	SPC-3
MODE SELECT (6)	15h	O	no	SPC-3
MODE SELECT (10)	55h	O	no	SPC-3
MODE SENSE (6)	1Ah	O	no	SPC-3
MODE SENSE (10)	5Ah	O	no	SPC-3
READ (6)	08h	M	yes	5.8
READ (10)	28h	M	yes	5.9
READ (12)	A8h	O	yes	5.10
READ (16)	88h	M	yes	5.11

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Table 1 — Commands for direct-access devices (part 2 of 3)

Command name	Operation code	Type [a]	Protection information	Reference
READ (32)	7Fh/0009h	O	yes	5.12
READ CAPACITY (10)	25h	M	no	5.13
READ CAPACITY (16)	9Eh/10h	M	no	5.14
REQUEST SENSE	03h	M	no	SPC-3
SEND DIAGNOSTIC	1Dh	M	no	SPC-3
SET DEVICE IDENTIFIER	A4h/06h	O	no	SPC-3
SET TARGET PORT GROUPS	A4h/0Ah	O	no	SPC-3
START STOP UNIT	1Bh	O	no	5.20
TEST UNIT READY	00h	M	no	SPC-3
VERIFY (10)	2Fh	O	yes	5.23
VERIFY (12)	AFh	O	yes	5.24
VERIFY (16)	8Fh	O	yes	5.25
VERIFY (32)	7Fh/000Ah	O	yes	5.26
WRITE (6)	0Ah	O	yes	5.27
WRITE (10)	2Ah	O	yes	5.28
WRITE (12)	AAh	O	yes	5.29
WRITE (16)	8Ah	O [c]	yes	5.30
WRITE (32)	7Fh/000Bh	O	yes	5.31
WRITE AND VERIFY (10)	2Eh	O	yes	5.32
WRITE AND VERIFY (12)	AEh	O	yes	5.33

Table 1 — Commands for direct-access devices (part 3 of 3)

Command name	Operation code	Type [a]	Protection information	Reference
WRITE AND VERIFY (16)	8Eh	O	yes	5.34
WRITE AND VERIFY (32)	7Fh/000Ch	O	yes	5.35

Notes:

[a] M = command implementation is mandatory. O = command implementation is optional. X = Command implementation requirements detailed in the reference.

[b] If either PERSISTENT RESERVE IN or PERSISTENT RESERVE OUT is implemented, both shall be implemented.

[c] If any of WRITE (6)/(10)/(12) is implemented, WRITE (16) shall also be implemented.

[d] Specified SCC-2 commands are supported only if the SCCS bit is set to one in the standard INQUIRY data (see SPC-3).

[e] Specified SMC-2 commands are supported only if the MCHGR bit is set to one in the standard INQUIRY data (see SPC-3).

The following operation codes are obsolete: 01h (REZERO UNIT), 0Bh (SEEK (6)), 16h (RESERVE (6)), 17h (RELEASE (6)), 18h (COPY), 2Bh (SEEK (10)), 30h (SEARCH DATA HIGH (10)), 31h (SEARCH DATA EQUAL (10)), 32h (SEARCH DATA LOW (10)), 33h (SET LIMITS (10)), 39h (COMPARE), 3Ah (COPY AND VERIFY), 40h (CHANGE DEFINITION), 56h (RESERVE (10)), 57h (RELEASE (10h)), 80h (XDWRITE EXTENDED (16)), 81h (REBUILD (16)), 82h (REGENERATE (16)), and B3h (SET LIMITS (12)).

The following operation codes are vendor-specific: 02h, 05h, 06h, 09h, 0Ch, 0Dh, 0Eh, 0Fh, 10h, 11h, 13h, 14h, 19h, 20h, 21h, 22h, 23h, 24h, 26h, 27h, 29h, 2Ch, 2Dh, and C0h through FFh.

All remaining operation codes for direct-access devices are reserved for future standardization.

5.3 FORMAT UNIT command

5.3.1 FORMAT UNIT command overview

The FORMAT UNIT command (see table 2) formats the medium into application client addressable logical blocks per the application client defined options. In addition, the medium may be certified and control structures may be created for the management of the medium and defects. The degree that the medium is altered by this command is vendor-specific.

Table 2 — FORMAT UNIT command

Byte\Bit	7	6	5	4	3	2	1	0
0	OPERATION CODE (04h)							
1	FMTPINFO	RTO_REQ	LONGLIST	FMTDATA	CMPLIST	DEFECT LIST FORMAT		
2	Vendor specific							
3	Obsolete							
4								
5	CONTROL							

The simplest ~~mandatory~~ form of the FORMAT UNIT command (i.e., a FORMAT UNIT command with no parameter data) accomplishes medium formatting with little application client control over defect management. The device server implementation determines the degree of defect management that is to be

performed. ~~Two additional mandatory forms of this command increase the application client's control over defect management. Several optional forms of this command further increase the application client's control over defect management, by allowing t~~The application client ~~to~~ may also specify:

a) defect list(s) to be used;
b) defect locations;
c) that logical unit certification be enabled; and
d) exception handling in the event that defect lists are not accessible.

During the format operation, the device server shall respond to commands as follows:

a) In response to all commands except REQUEST SENSE and INQUIRY, the device server shall return CHECK CONDITION status unless a reservation conflict exists, in which case RESERVATION CONFLICT status shall be returned;
b) In response to the INQUIRY command, the device server shall respond as commanded; and
c) In response to the REQUEST SENSE command, unless an error has occurred, the device server shall return a sense key of NOT READY with the additional sense code set to LOGICAL UNIT NOT READY FORMAT IN PROGRESS, with the sense key specific bytes set for progress indication (see SPC-3). See SPC-3 for a description of deferred error handling that may occur during the format operation.

> NOTE 1 - The MODE SELECT parameters, if any, should be set prior to issuing the FORMAT UNIT command.

During the processing of the FORMAT UNIT command, the device server may perform a medium defect management algorithm. The algorithm may be controlled by the application client, using ~~optional forms of this command~~an optional parameter list. Four sources of defect location information (i.e., defects) are defined as follows:

a) Primary defect list (PLIST). This is the list of defects, that may be supplied by the original manufacturer of the device or medium, that are considered permanent defects. The PLIST is located outside of the application client-accessible logical block space. The PLIST is accessible by the device server ~~(to reference while formatting)~~, but it is not accessible by the application client except through the READ DEFECT DATA command. Once created, the original PLIST shall not be subject to change;
b) Logical unit certification list (CLIST). This list includes defects detected by the device server during an optional certification process performed during the FORMAT UNIT command. This list shall be added to the GLIST;
c) Data defect list (DLIST). This list of defect descriptors may be supplied by the application client to the device server during the the FORMAT UNIT command. This list shall be added to the GLIST. If the DEFECT LIST LENGTH field in the defect list header is set to zero, there is no DLIST; and
d) Grown defect list (GLIST). The GLIST includes all defects sent by the application client or detected by the device server. The GLIST does not include the PLIST. If the CMPLST bit is set to zero, the GLIST shall include DLISTs provided to the device server during the previous and the current FORMAT UNIT commands. The GLIST shall also include:
   A) defects detected by the format operation during medium certification;
   B) defects previously identified with a REASSIGN BLOCKS command (see 5.19); and
   C) defects previously detected by the device server and automatically reallocated.

Table 3 defines the defect descriptor requirements for the FORMAT UNIT command.

Table 3 — FORMAT UNIT defect descriptor format and requirements

Field in the FORMAT UNIT CDB			DEFECT LIST LENGTH **field in the defect list header**	Type [a]	Comments
FMTDATA	CMPLST	DEFECT LIST FORMAT			
0	0	000b	N/A	M	Vendor-specific defect information
1	0	000b (short block)	Zero	~~M~~O	See notes [b] and [d]
1	1		Zero	~~M~~O	See notes [b] and [e]
1	0		> 0	O	See notes [c] and [d]
1	1		> 0	O	See notes [b] and [e]
		011b (long block)	Zero	O	See notes [b] and [d]
			Zero	O	See notes [b] and [e]
1	0		> 0	O	See notes [c] and [d]
1	1		> 0	O	See notes [c] and [e]
1	0	100b (bytes from index)	Zero	O	See notes [b] and [d]
1	1		Zero	O	See notes [b] and [e]
1	0		> 0	O	See notes [c] and [d]
1	1		> 0	O	See notes [c] and [e]
1	0	101b (physical sector)	Zero	O	See notes [b] and [d]
1	1		Zero	O	See notes [b] and [e]
1	0		> 0	O	See notes [c] and [d]
1	1		> 0	O	See notes [c] and [e]
1	0	110b (vendor specific)	Vendor specific		
1	1				
All others				All remaining codes are reserved.	

Notes:
[a] M = implementation is mandatory. O = implementation is optional.
[b] No DLIST is transferred to the device server in the parameter list.
[c] A DLIST is transferred to the device server in the parameter list. Add the DLIST defects to the new GLIST.
[d] Use the existing GLIST as a defect source. Add existing GLIST defects to the new GLIST.
[e] Discard the existing GLIST. Do not add existing GLIST defects to the new GLIST.

All the options described in this table cause a new GLIST to be created during processing of the FORMAT UNIT command as described in the text.